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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09 293,188	04 16 1999	ZHIPING YIN	11675.165.1	4546

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EXAMINER

CAO, PHAT X

ART UNIT PAPER NUMBER

2814

DATE MAILED: 03/26/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/293,188

Applicant(s)

YIN ET AL.

Examiner

Phat X. Cao

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 27 December 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,7-10,15-20,29 and 30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-2, 7-10, 15-20, 29-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-2, 7-10, 15-20 and 29-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekiguchi et al (US. 5,780,908) in view of Hong et al (US. 6,077,774).

Sekiguchi et al disclose in Fig. 3(b) a semiconductor structure comprising: an electrically conductive interconnect disposed within a first dielectric layer 4, the electrically conductive interconnect having an upper surface and including: a titanium/titanium nitride bilayer film 6 disposed within a depression in the first dielectric layer 4; a tungsten film 7 disposed upon the titanium/titanium nitride bilayer film 6 and filling the depression; a passivation layer 7b of tungsten nitride layer, disposed upon the upper surface and having a thickness of less than 50 angstroms (column 16, lines 20-24), the passivation layer 7b formed by exposing the surface of the electrically conductive interconnect 7 to plasma in an atmosphere of ammonia (NH₃) (column 15, lines 50-54) for nitriding an area in the vicinity of the surface of the electrically conductive interconnect 7 (column 15, lines 50-54). Therefore, the passivation layer 7b of tungsten nitride (WN) would inherently comprise Hydrogen (H) adsorbed upon the upper surface

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for forming the chemical structure W-N-H (claim 1). It is noted that a first passivation layer comprising tungsten nitride and a second passivation layer comprising ammonia as claimed in claims 7, 17, 19 and 30 do not distinguish from the passivation layer 7b of tungsten nitride comprising ammonia derivatives (N and H) of Sekiguchi which can be arbitrarily subdivided into numerous sub-layers about each other. It is also noted that because the passivation layer 7b of tungsten nitride in the vicinity of the surface of the interconnect (column 12, lines 29-37) to a thickness of several nm for functioning as a barrier layer (column 11, lines 33-35), the passivation layer 7b would inherently chemically protect at least one atomic lattice layers of the interconnect.

Sekiguchi et al do not disclose an ILD disposed upon the first dielectric layer 4 and being continuously adhered to the upper surface.

However, Hong et al teach in Fig. 1F the obviousness of forming an ILD 36 upon the dielectric layer 12 and continuously adhered to the upper surface of the electrically conductive interconnect 30. Accordingly, it would have been obvious to form an ILD upon the dielectric layer 4 and continuously adhered to the upper surface of the electrically conductive interconnect 7 of Sekiguchi, because the ILD would provide the known purpose of isolating and protecting the electrically conductive interconnect from the outside ambient. Note that process limitations (i.e., forming by Brunauer's Type V adsorption, forming by exposing to a plasma consisting essentially of a nitrogen-containing silane) do not carry weight in a claim drawn to structure. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

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3. Claims 1-2, 7-10, 15-20 and 29-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekiguchi et al in view of Liao (US. 6,114,238).

As discussed above, Fig. 3(b) of Sekiguchi et al substantially reads on the above claims, except it does not disclose an ILD disposed upon the first dielectric layer and being continuously adhered to the upper surface of the conductive interconnect.

However, in view of Fig. 1 of Liao, it would have been obvious to form an ILD upon the dielectric layer 4 and continuously adhered to the upper surface of the conductive interconnect 7 of Sekiguchi, because the ILD would provide the known purpose of isolating and protecting the electrically conductive interconnect from the outside ambient.

Response to Arguments

4. Applicant argues that Sekiguchi does not suggest the passivation layer comprises the chemical structure M-N-H (claim 1) and chemically protects about 1-1,000 atomic lattice layers of the interconnect.

Applicant's arguments are not persuasive because Sekiguchi does suggest the above features (see ground of rejection for details).

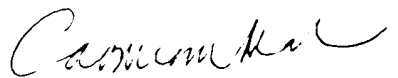
5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is (703) 308-4917. The Examiner can normally be reached on Monday through Thursday. If attempts to reach the Examiner by

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telephone are unsuccessfully, the Examiner's supervisor, Wael Fahmy, can be reached on (703) 308-4918.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0956. Group 2800 fax number is (703) 308-7722 or (703) 308-7724.

PC
March 23, 2003


PHAT A. CAL
PRIMARY EXAMINER